

CLAIMS

What is claimed is:

1. A method for controlling the fueling of a hybrid electric motor vehicle having an internal combustion engine, a motor/generator, and a continuously variable transmission, the method comprising the steps of:
 - sensing throttle position of the internal combustion engine;
 - 5 slewing the continuously variable transmission to a higher gear ratio in response to sensing a closed throttle position;
 - cutting fueling of the internal combustion engine; and
 - coupling the motor/generator in parallel with the internal combustion engine with the motor/generator operating as a generator.
- 10 2. The method of claim 1 further comprising the step, following the step of cutting fueling, of maintaining engine RPM of the internal combustion engine constant until the motor vehicle speed decreases to a first predetermined vehicle speed.
3. The method of claim 2 further comprising the step of slewing the continuously variable transmission to a lower gear ratio when the motor vehicle speed reaches the first predetermined vehicle speed to cause the internal combustion engine to be backdriven.
4. The method of claim 1 further comprising the steps of:
 - monitoring speed of the motor vehicle; and
 - terminating the step of coupling the motor/generator in parallel with the internal combustion engine with the motor/generator operating as a
 - 5 generator in response to the speed of the motor vehicle decreasing to a second predetermined vehicle speed.

5. The method of claim 4 further comprising the step of coupling the motor/generator in parallel with the internal combustion engine with the motor/generator operating as a motor following the step of terminating.

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6. The method of claim 5 wherein the step of coupling the motor/generator in parallel with the internal combustion engine with the motor/generator operating as a motor comprises the step of operating the motor/generator as a motor to maintain the internal combustion engine RPM substantially constant.

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7. The method of claim 6 wherein the hybrid electric vehicle further comprises a battery pack coupled to the motor/generator and wherein the method further comprises the steps of:

monitoring the battery pack state of charge; and

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controlling the motor/generator operating as a motor as a function of the monitored state of charge.

8. The method of claim 7 wherein the step of controlling the motor/generator operating as a motor comprises the step of controlling the motor/generator to cause the motor vehicle speed to decrease to zero without refueling the internal combustion engine.

9. The method of claim 1 wherein the hybrid electric vehicle further comprises a battery pack coupled to the motor/generator and wherein the method further comprises the steps of:

monitoring the battery pack state of charge; and

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controlling the motor/generator operating as a generator as a function of the monitored state of charge.

10. The method of claim 9 wherein the step of controlling comprises the step of controlling the step of slewing the continuously variable transmission.

11. The method of claim 9 wherein the hybrid electric vehicle further comprises an air conditioning compressor and wherein the step of controlling further comprises the step of controlling the motor/generator operating as a generator as a function of air conditioner compressor load.

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12. A method for controlling the fueling of a hybrid electric motor vehicle having an internal combustion engine, a continuously variable transmission coupled to the internal combustion engine, and an electric motor/generator capable of being coupled in parallel with the internal combustion engine, the method comprising the steps of:

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monitoring the position of an accelerator pedal coupled to the internal combustion engine;

slowing the motor vehicle in response to the monitored position of the accelerator pedal indicating an intent to slow the motor vehicle by combining internal combustion engine braking and motor/generator braking; and

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reducing the amount of internal combustion engine braking by slewing the continuously variable transmission to a higher gear ratio.

13. The method of claim 12 wherein the step of slowing the motor vehicle comprises the step of controlling the amount of internal combustion engine braking and motor/generator braking to maintain a smoothly changing motor vehicle speed.

14. The method of claim 13 wherein the motor vehicle further comprises a battery pack coupled to the motor/generator and the method further comprises the steps of:

- monitoring the state of charge of the battery pack; and
- 5 controlling the amount of motor/generator braking in response to the monitored state of charge of the battery pack.

15. The method of claim 12 further comprising the steps of:

- monitoring time following the monitored position of the accelerator pedal indicating an intent to slow the motor vehicle; and
- cutting fueling to the internal combustion engine in response to the
- 5 monitored time exceeding a first predetermined time.

16. The method of claim 15 further comprising the step of coupling the motor/generator as a motor in parallel with the internal combustion engine to maintain a non-zero speed of the motor vehicle after the step of cutting fueling.

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- 17. The method of claim 15 further comprising the step of coupling the motor/generator as a motor in parallel with the internal combustion engine to increase the internal combustion engine RPM to restart the internal combustion engine in response to monitoring the position of the accelerator pedal and detecting an intent to accelerate the motor vehicle.

18. The method of claim 12 wherein the step of slowing the motor vehicle by internal combustion engine braking comprises the step of backdriving the internal combustion engine.

19. The method of claim 18 wherein the step of backdriving the internal compression engine comprises the step of slewing the gear ratio of the continuously variable transmission to adjust the amount of backdriving.

20. The method of claim 18 wherein the step of backdriving the internal combustion engine comprises the step of engaging a torque converter clutch to couple the internal combustion engine to wheels of the motor vehicle.
21. The method of claim 20 wherein the step of engaging a torque converter clutch comprises the step of engaging a reverse freewheeler torque converter clutch.
22. A method for controlling the fueling of a hybrid electric motor vehicle having an internal combustion engine, a continuously variable transmission coupled to the internal combustion engine, and an electric motor/generator capable of being coupled in parallel with the internal combustion engine, the method comprising the steps of:
- 5 sensing an intent to decelerate the motor vehicle;
 slewing the continuously variable transmission to a higher gear in response to sensing such intent;
 coupling the motor/generator in parallel with the internal combustion
10 engine and operating the motor/generator as a generator;
 cutting fueling to the internal combustion engine;
 maintaining internal combustion engine RPM substantially constant for a preselected period of time as the motor vehicle speed is decreased;
 terminating the step of operating the motor/generator as a generator;
15 propelling the motor vehicle at a slow and slowly declining speed;
 applying pressure to a brake pedal to stop the motor vehicle;
 releasing pressure on the brake pedal indicative of an intent to accelerate the motor vehicle;
 again coupling the motor/generator as a motor in parallel with the
20 internal combustion engine to spin the internal combustion engine to an RPM at which starting can occur; and
 refueling and starting the internal combustion engine.

23. The method of claim 22 wherein following the step of propelling, the method further comprises the step of causing an electric transmission pump to maintain a minimum line pressure in the continuously variable transmission.
24. The method of claim 22 wherein the motor vehicle further comprises a battery pack coupled to the motor/ generator, the method further comprising the step of monitoring the state of charge of the battery pack and wherein the step of propelling comprises coupling the motor/generator as a motor in
5 parallel with the internal combustion engine in response to monitoring a high state of charge of the battery pack.
25. The method of claim 22 wherein the motor vehicle further comprises a battery pack coupled to the motor/ generator, the method further comprising the step of monitoring the state of charge of the battery pack and wherein the step of propelling comprises refueling and restarting the internal combustion
5 engine in response to monitoring a low state of charge of the battery pack.
26. The method of claim 22 further comprising the steps of:
monitoring deceleration rate of the motor vehicle; and
stopping the internal combustion engine at a non-zero vehicle speed in response to monitoring a non-abrupt deceleration rate.
27. The method of claim 22 further comprising the steps of:
monitoring deceleration rate of the motor vehicle; and
stopping the internal combustion engine at zero vehicle speed in response to monitoring an abrupt deceleration rate.